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recent experiments of Geiger, however, show that the scattering of the α particles is very marked, and is so great that a small fraction of the α particles, which impinge on a screen of metal, have their velocity reversed in direction and emerge again on the same side. This scattering can be most conveniently studied by the method of scintillations. It can be shown that the deflection of the α particle from its path is quite perceptible after passing through very few atoms of matter. The conclusion is unavoidable that the atom is the seat of an intense electric field, for otherwise it would be impossible to change the direction of the particle in passing over such a minute distance as the diameter of a molecule.

In conclusion, I should like to emphasize the simplicity and directness of the methods of attack on atomic problems opened up by recent discoveries. As we have seen, not only is it a simple matter, for example, to count the number of α particles by the scintillations produced on a zinc sulphide screen, but it is possible to examine directly the deflection of an individual particle in passing through a magnetic or electric field, and to determine the deviation of each particle from a rectilinear path due to encounters with molecules of matter. We can determine directly the mass of each α particle, its charge, and its velocity, and can deduce at once the number of atoms present in a given weight of any known kind of matter. In the light of these and similar direct deductions, based on a minimum amount of assumption, the physicists have, I think, some justification for their faith that they are building on the solid rock of fact, and not, as we are often so solemnly warned by some of our scientific brethren, on the shifting sands of imaginative hypothesis.

E. RUTHERFORD

THE HIGHEST BALLOON ASCENSION IN AMERICA

ALTHOUGH a large number of *ballons-sondes* were despatched from St. Louis in 1904-7 under the direction of the writer (see SCIENCE, Vol. 27, p. 315), none had been employed in the eastern states until last year. In May and July, 1908, four *ballons-sondes* were launched from Pittsfield, Mass., with special precautions to limit the time they remained in the air and so prevent them from drifting out to sea with the upper westerly wind. Three of the registering instruments have been returned to the Blue Hill Observatory with good records. The first instrument sent up on May 7 was not found for ten months and the record, forming the subject of the present article, is very interesting because it gives complete temperature data from the ground up to 17,700 meters, or 11 miles. This is 650 meters higher than the highest ascension from St. Louis, which, by a coincidence, was also the first one to be made there. On May 7 a general storm prevailed, so that the balloon, traveling from the east, was soon lost in the cloud and its subsequent drift could not be followed, but the resultant course was 59 miles from the southwest, as determined by the place where the instrument fell two hours later. At the ground the temperature was $4^{\circ}.5$ C., and this decreased as the balloon rose to the base of the cloud, which itself was considerably warmer than the underlying air. Above the cloud the temperature continued to fall with increasing rapidity up to a height of 12,500 meters (nearly eight miles) where the minimum of $-54^{\circ}.5$ C. was registered. Here the great warm stratum was entered and penetrated farther than ever before in this country, namely, to the height of 17,700 meters, where the temperature was $-46^{\circ}.5$ C. An increase of $8^{\circ}.9$ occurred, however, in the first 3,000 meters, for above 15,500 meters nearly isothermal conditions prevailed, confirming the belief of Teisserenc de Bort that what he calls the "stratosphere" is composed of a lower inverting layer with isothermal conditions above extending to an unknown height. In an ascension last November in Belgium the

relatively warm stratum was found to extend from 12,900 meters to the enormous height of 29,000 meters, or 18 miles, where there was still no indication of its diminution.

A. LAWRENCE ROTCH

LETTERS FROM CHARLES DARWIN

IN 1882 I published in a history of Pettis County, Missouri, the following:

A flock of geese, belonging to ex-Marshall Kelly, of Sedalia, presents an interesting feature of malformations. In 1873 a gander had one of its wings so injured that it hung horizontally at right angles to the body, in the same manner as is not infrequently seen in other flocks, a result of injuries received. In 1874, one of the young of the flock presented a wing similarly affected; the following year its offspring showed the same features, and this has been continued to the present time. As many as two thirds of the flock have at one time presented this peculiarity, some in both wings. Believing that it was a case of "the inheritance of effects of injuries," Mr. R. A. Blair published an account of it, and sent a copy to Mr. Charles Darwin, and received from him the following letter:

Dear Sir: I am much obliged to you for kindly informing me of the case of the goose. It seems to be a remarkable case of inheritance of effects of injury, and as such cases are very rare, it would be quite worth while to have the facts carefully examined. If you could obtain a wing, and would send it to me, I should be much obliged. The wing might be cut off at the joint with the body, and dried with feathers on, before a hot fire. To make the case of more value, it would be very advisable to ascertain whether the goose had any offspring before the injury, and if so, whether they were normal, and not malformed in any way.

Dear sir, yours faithfully,

CHARLES DARWIN

Mr. Blair then sent a wing of one of the geese, and received the following answer:

Dear Sir: You will think that I have been very neglectful in not having sooner thanked you for the wing of the goose, the photograph, and your last interesting letter; but I thought it best to wait until receiving Professor Flower's report, and you will see by the enclosed the cause of his delay. If you are willing to take the trouble to get your interesting case thoroughly investigated,

it will be necessary to procure from the owner the wings of a half dozen birds, some of them quite young; and, if possible, the old one which had his wing broken. They ought to be sent in spirits, and they had better be addressed to Professor Flower, Royal College of Surgeons, Lincoln's Inn Fields, London, and I had better be informed when they are dispatched. Should you be inclined to take so much trouble, I hope you will allow me to say that I should be very glad to pay for the geese, and for the several other contingent expenses. Your first letter and Professor Flower's had better be returned to me hereafter. There is one other point which ought, if possible, to be ascertained, viz: when the old gander had his wing broken, was it wounded so that blood was discharged? If wounded, did the wound suppurate? Did the wing heal quickly or slowly? These are important points in relation to the inheritance of mutilations. Pray accept my best thanks for your kindness, and I remain, Dear Sir,

Yours faithfully,

CHARLES DARWIN

A number of wings were then sent to Dr. Flower, who made a report to Mr. Darwin, in which he says:

The bones, muscles, and ligaments seem quite normal, except for this twisting on their axis, which exactly corresponds, as I mentioned before, to *talipes* or club foot in man. The wings of the very little goslings being dried and very small could not be examined with any good result, but the most curious and unsatisfactory part of the whole thing is that the wing of the old gander, the supposed *for et origo* of all the mischief, is perfectly normal, and presents no trace of ever having been injured in any way discoverable after the closest examination. It has certainly never been broken or dislocated, though, of course, we can not be sure whether it may not have had a partial twist from which it has now recovered.

With this letter and with the full and detailed report of Dr. Flower's assistant, Mr. Darwin wrote as follows:

Dear Sir: Professor Flower has suffered from a long illness, and this has caused much delay in the examination of the wings of the geese. But I received yesterday his report and letter which I enclose, as you may like to see them. I fear there is no connection between the deformity and the injury. The owner when he saw several goslings thus deformed, a not uncommon form of